CUTTING EDGE VISIONARIES

Presents

CEV TALK ON BASIC ROBOTICS

By:-Nikunj G Katkoria

What is Robotics?

- **Robotics** is the branch of technology that deals with the design,construction,operation, and application of robots,as well as computer systems for their control,sensory feedback, and information processing.

What is a Robot?

- A Robot is an artificial agent,usually an electro-mechanical machine that is guided by an electronic circuitary

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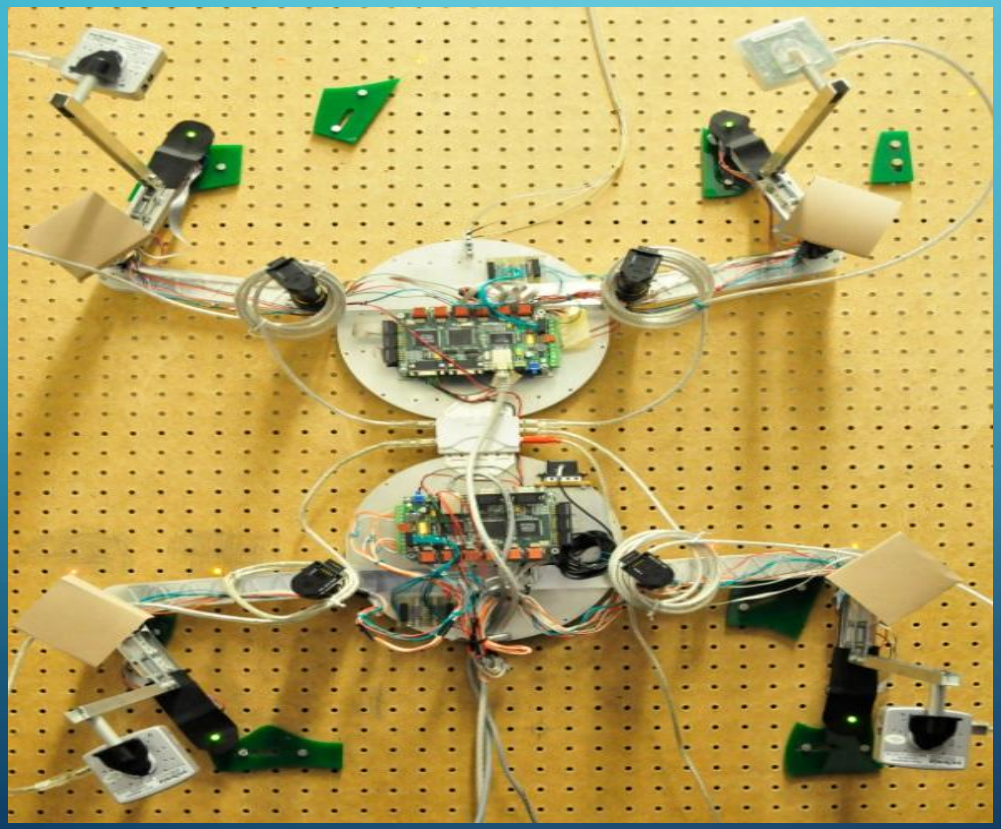
Different types of robots



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Different types of robots

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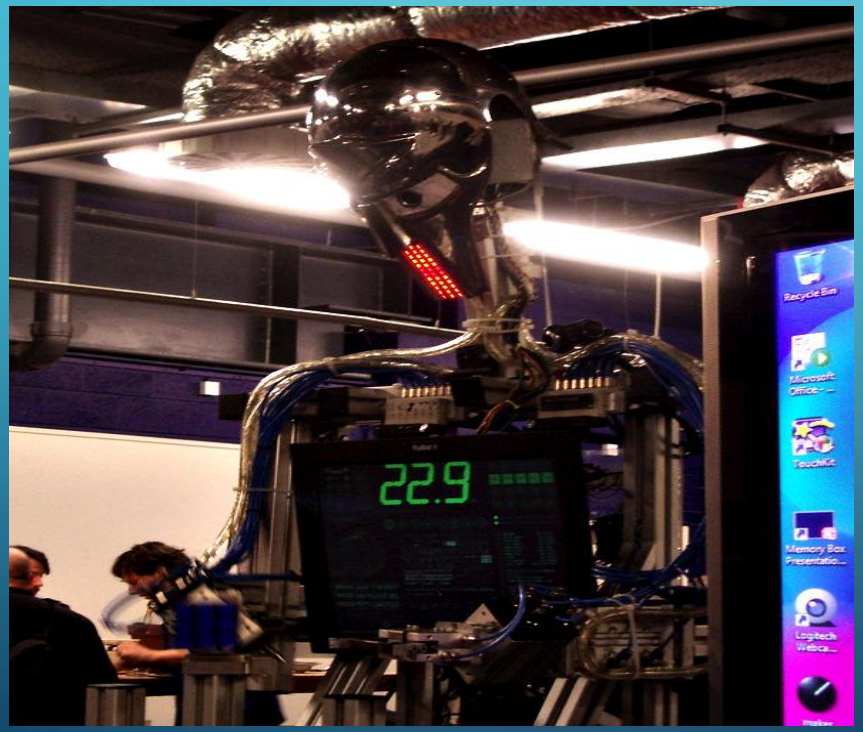
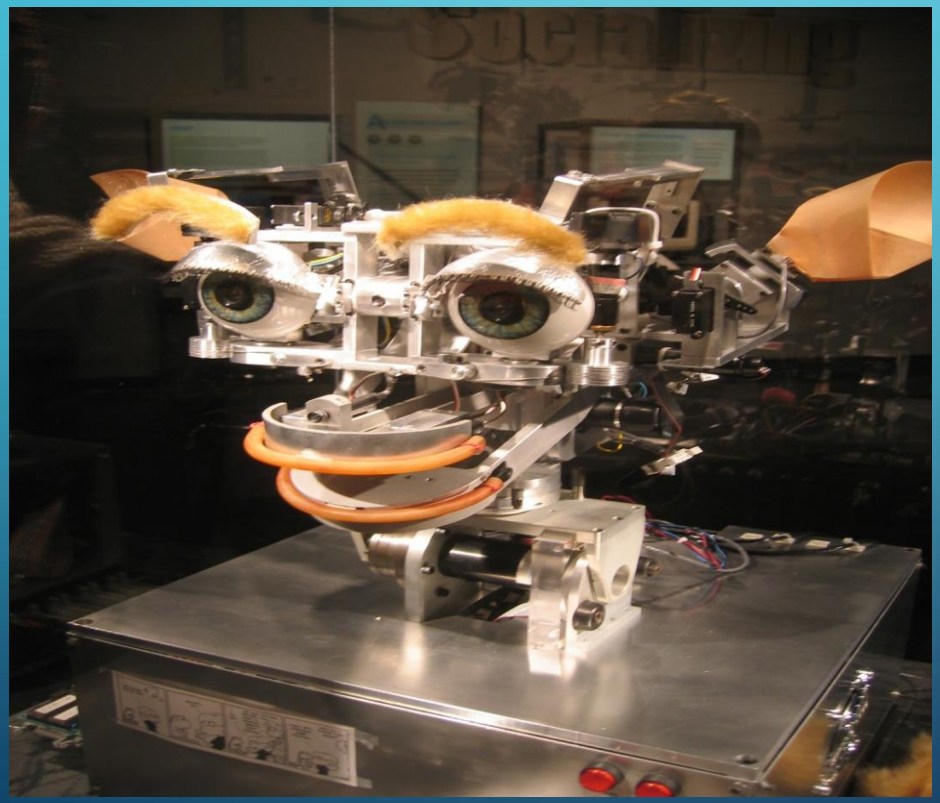
Different types of robots



Different types of robots



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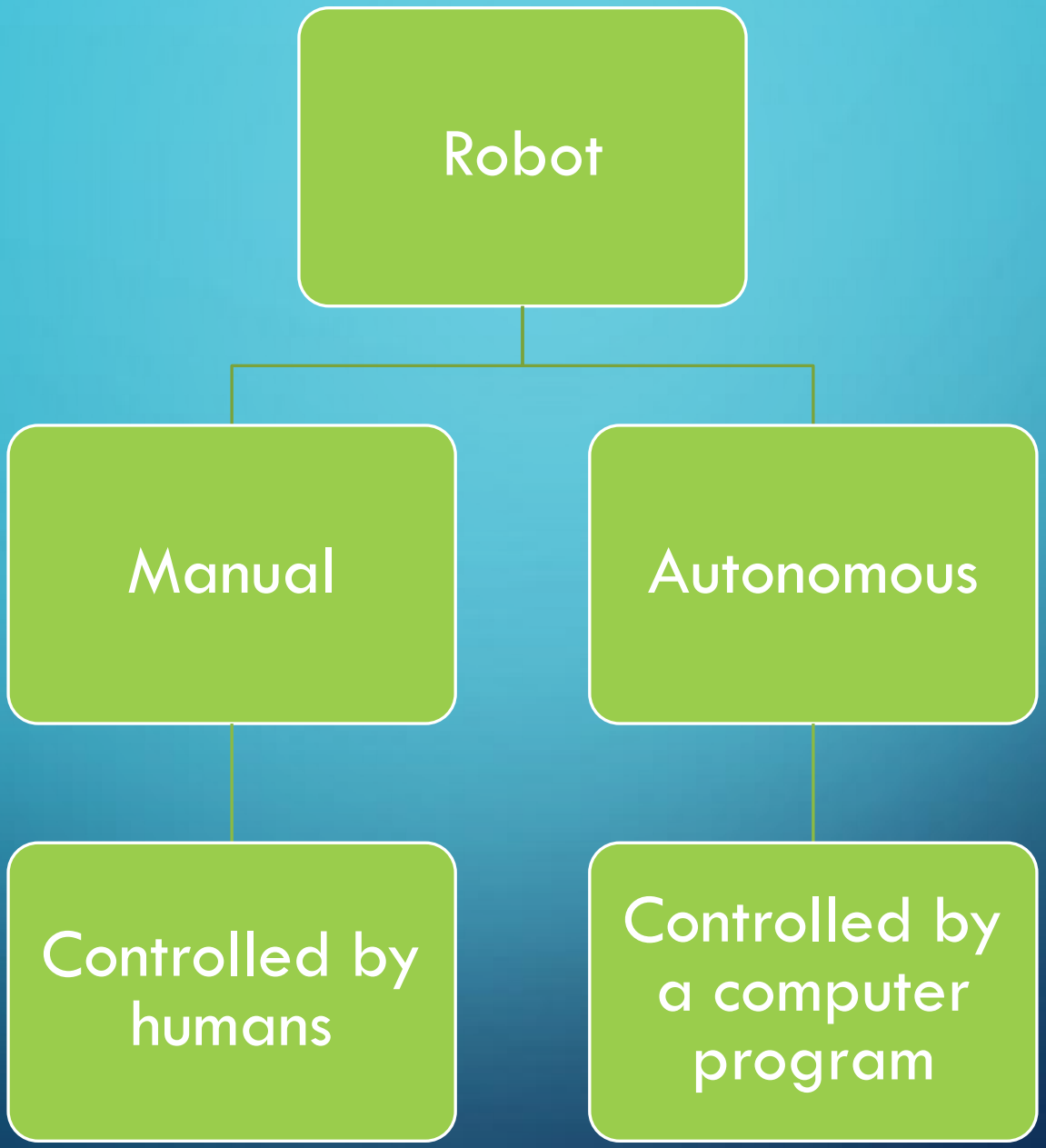
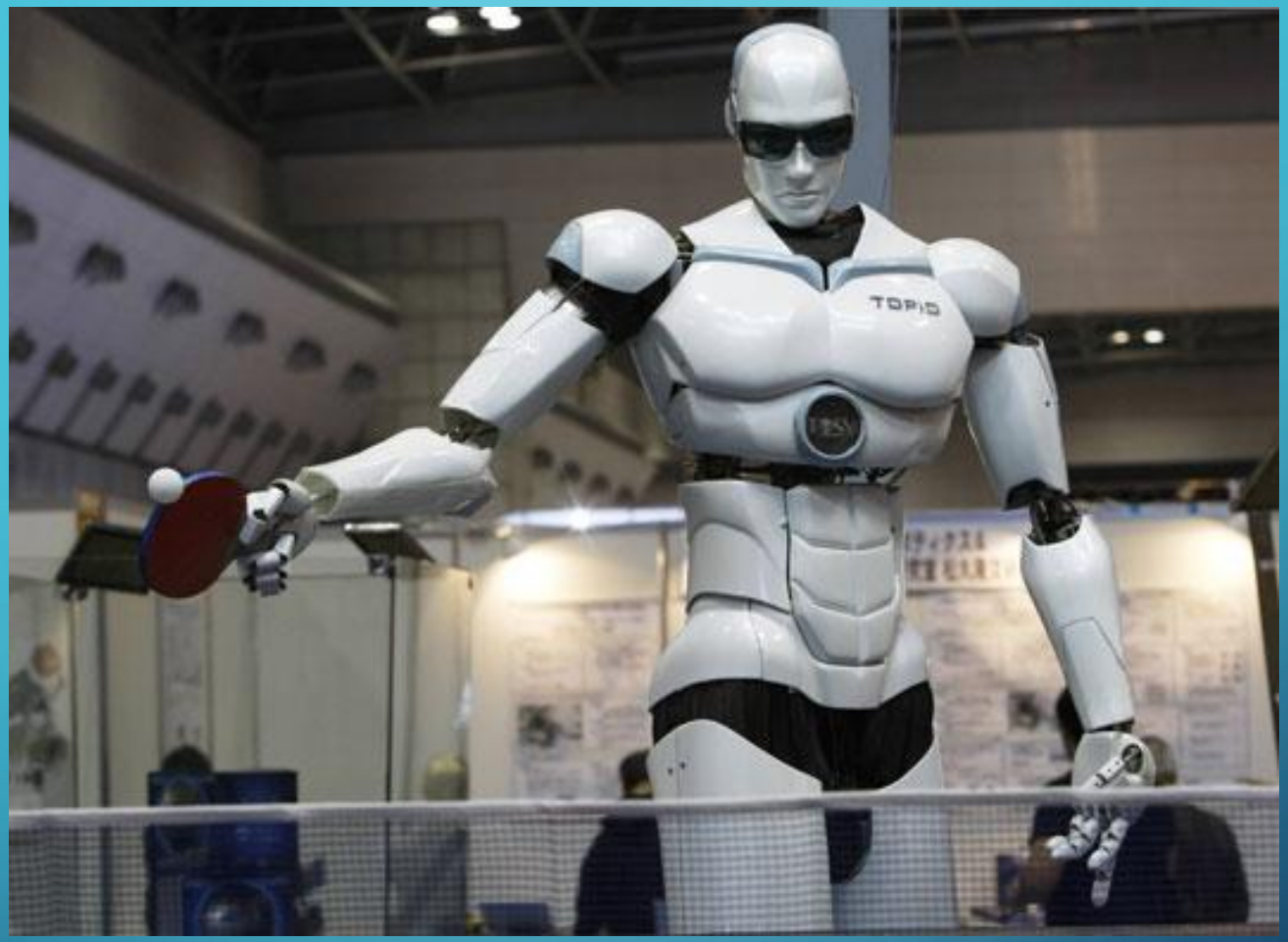

Robot
Manual
Autonomous
Controlled by humans
Controlled by a computer program



An autonomous programmed robot playing table tennis

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Basic parts of a manual robot

- A movable body(Wheels, Legs)
- Chassis
- An actuator(Motors, hydraulics, pneumatics)
- A power system(Batteries)
- An electrical circuit(Wires, printed circuit boards, remote controller)

A movable body

- For robots to move, it should have a movable body which makes it move place to place.

- Robots may have wheels or limbs connected by mechanical joints or other types of movable segments

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Chassis

- Chassis is the framework of a robot on which all the systems is mount

- Chassis gives support to all the robot components

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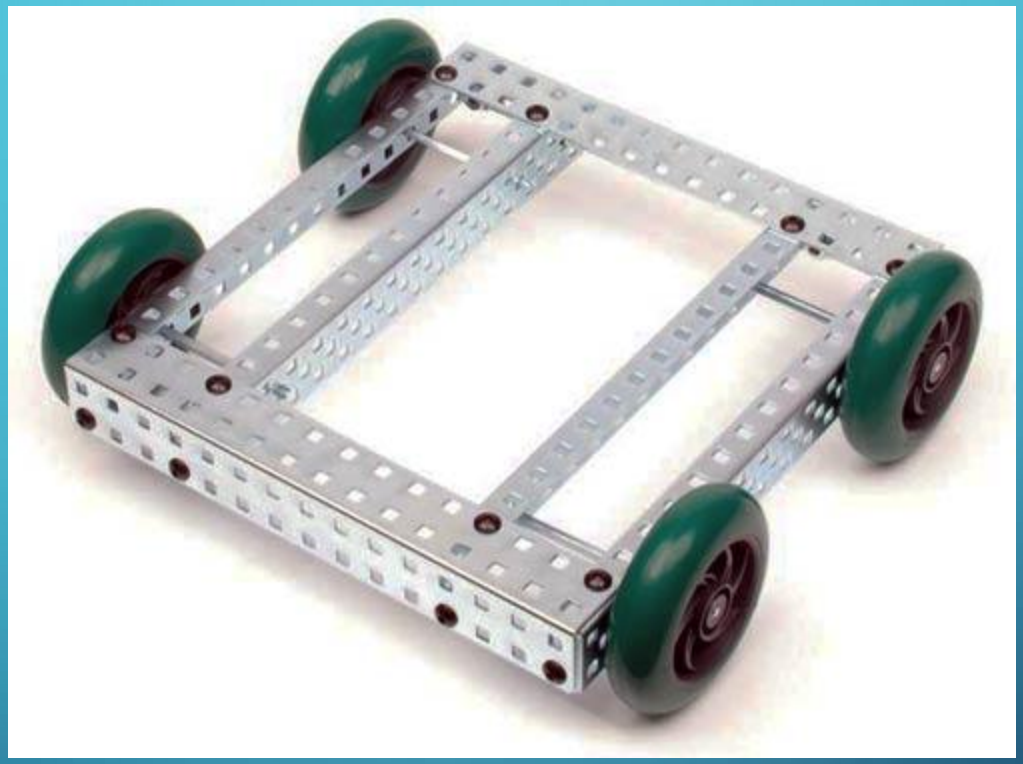
Chassis



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Chassis

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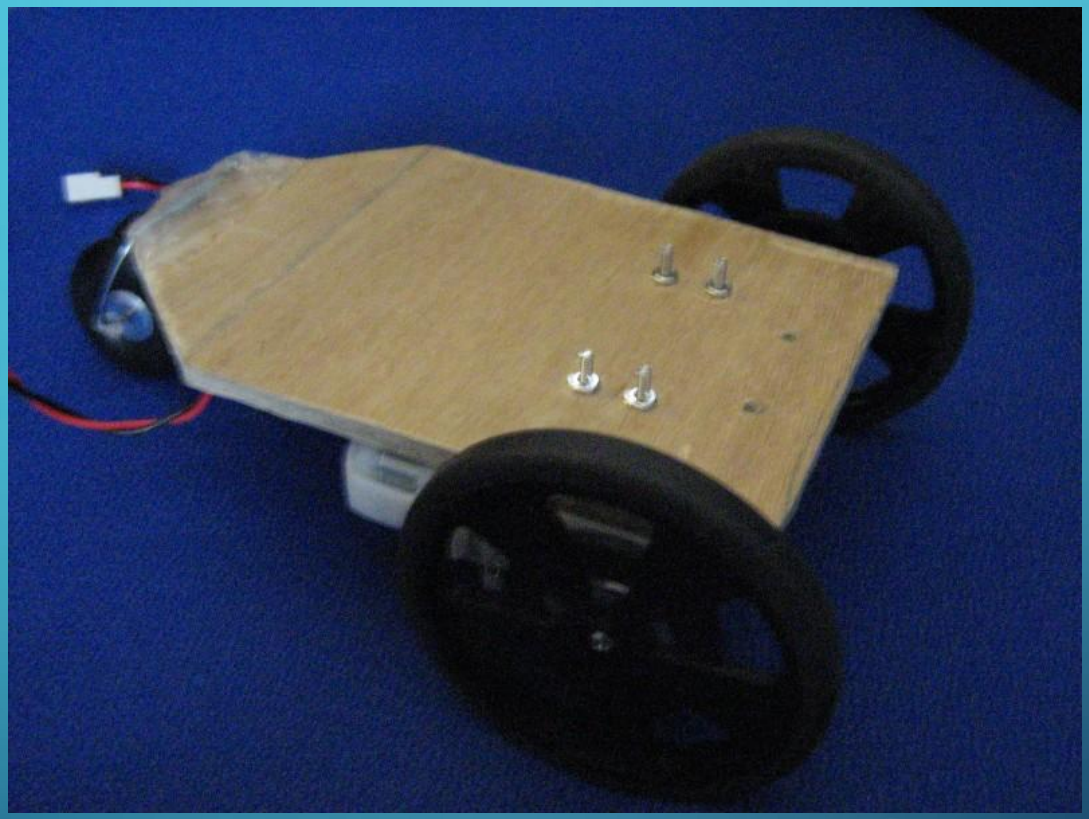
Chassis



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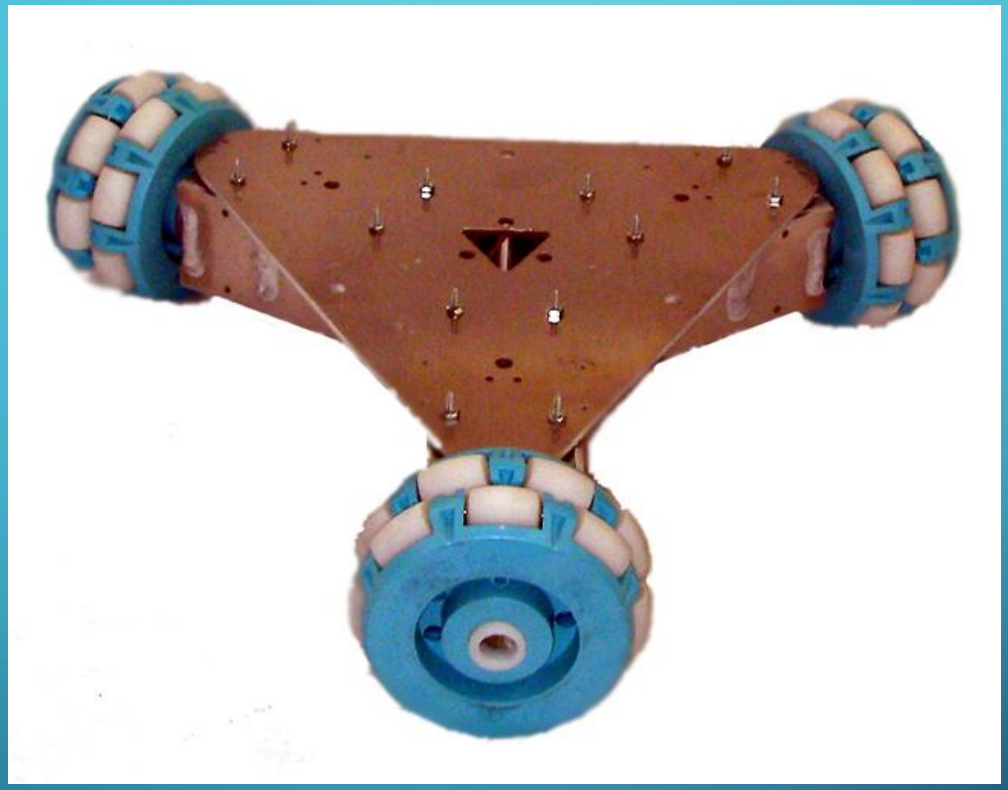
Chassis



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Wheels

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Factors for selection of wheels

- Diameter-Speed and torque analysis
- Grip-Avoid slipping in sand, smooth surfaces, etc.
- Ground Clearance
- Material-Weight of robot and self weight

Ground Clearance

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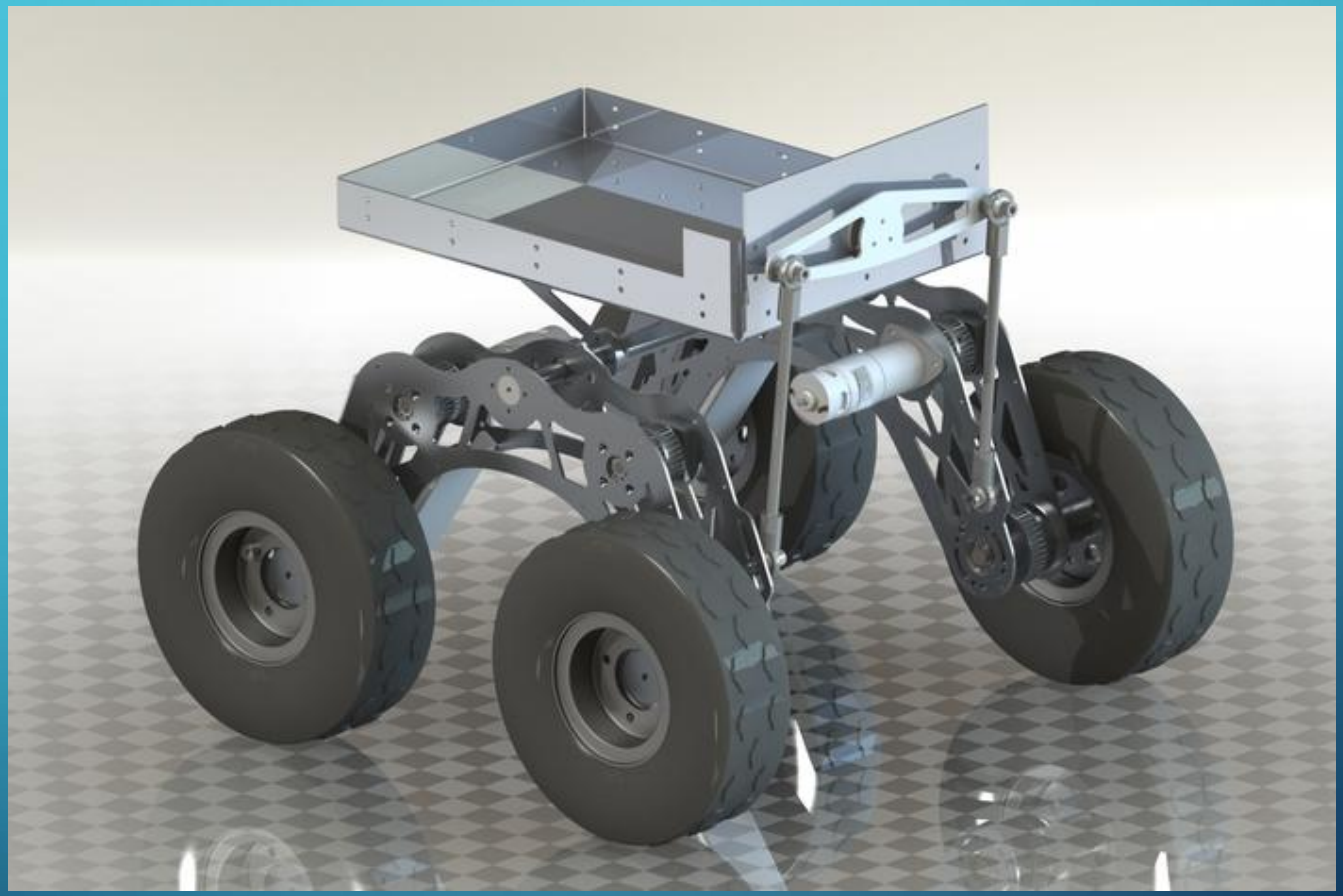
Types of wheels



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Types of wheels

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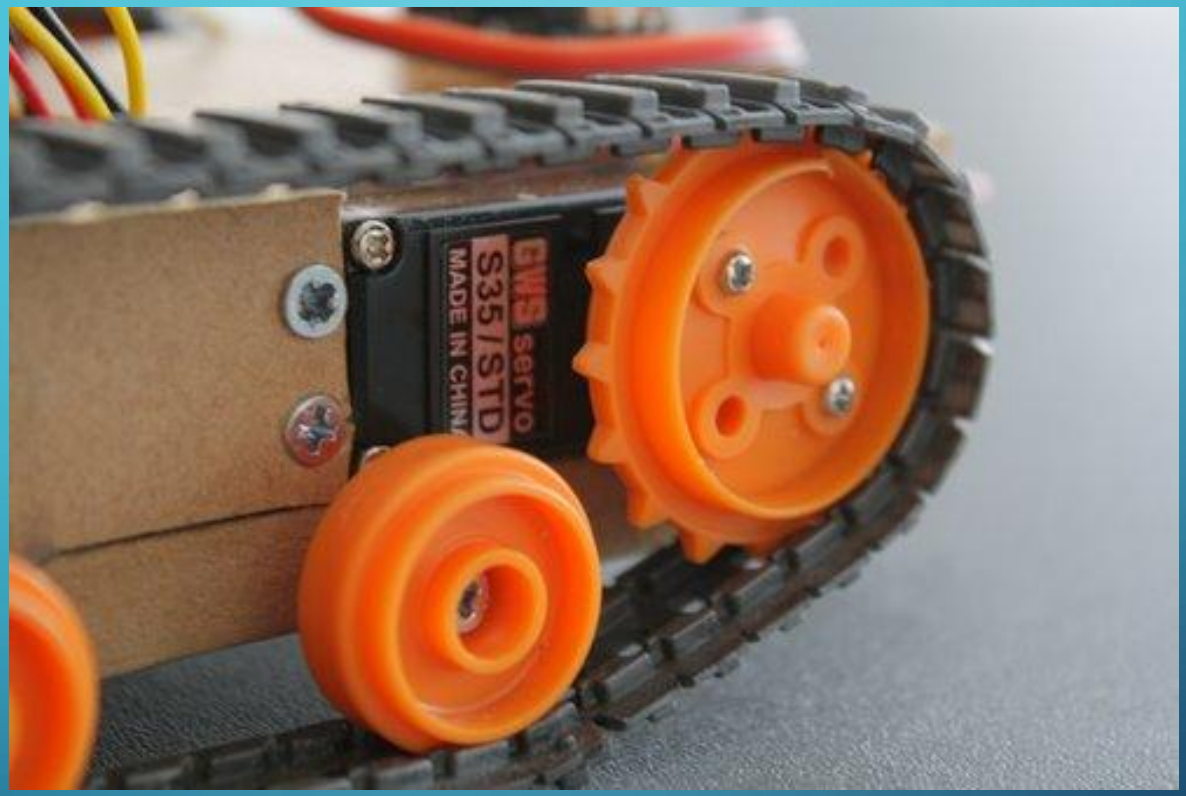
Types of wheels



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Actuators

- Actuators are devices which moves a component,in response to signals from the controller
- Actuators may be electric(motors), hydraulic or pneumatic

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Types of motors

- DC Motors
- The servos
- Stepper motors

DC Motors

- DC Motors are the cheapest motors and are controlled in speed only
- Perfect to control wheels and fans in small projects
- Not so accurate in position

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DC Motors

- 10RPM 12V DC motors with Gearbox
- 6mm shaft diameter with internal hole
- 125gm weight
- Same size motor available in various rpm
- 5kgcm torque
- No-load current = 60 mA(Max), Load current = 300 mA(Max)

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- 60RPM 12V DC motors with Metal Gearbox
- 18000 RPM base motor
- 6mm shaft diameter
- Gearbox diameter 37 mm.
- Motor Diameter 28.5 mm
- Length 63 mm without shaft
- Shaft length 15mm
- 300gm weight
- 10kgcm torque
- No-load current = 800 mA(Max), Load current = upto 9.5 A(Max)

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Ampflow

- Peak Horsepower 4.5
- Motor Diameter 3 in
- Reduction Ratio 8.3:1
- Peak Torque 1070kg-cm
- Nominal Voltage 24V
- No-Load RPM 580
- Weight 4.8

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The servos

- Easy to control
- Controlled in position
- Constrained at a specific angle
- Perfect for robot arms, hands, grippers, etc.
- High torque

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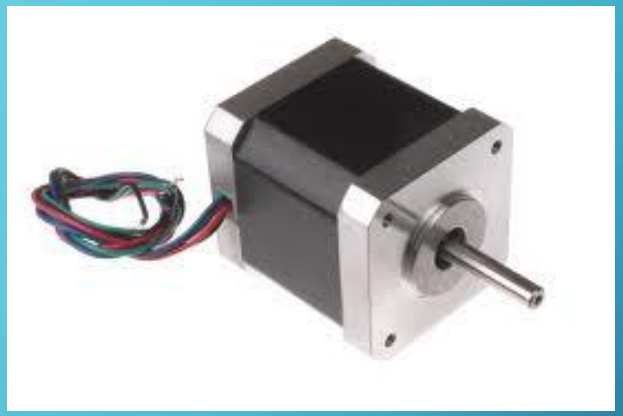
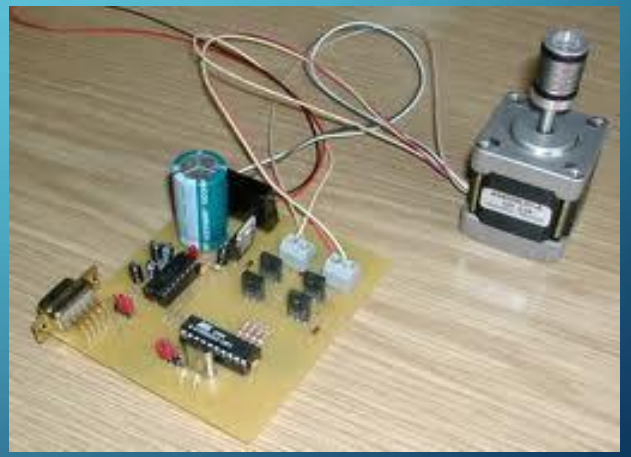
Stepper motors

- Harder to control
- More expensive
- More accurate and have more torque
- Needs a motor controller
- Prefect for maze finding robots





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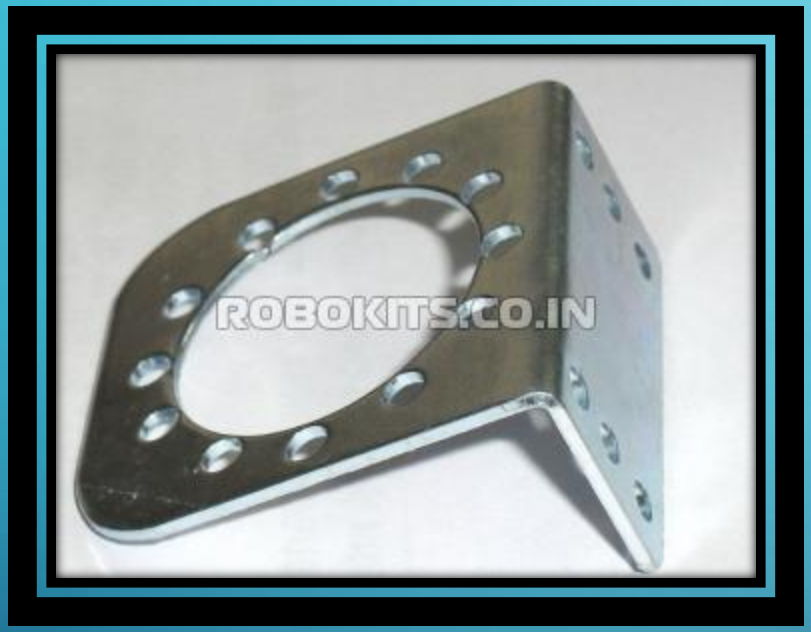
How to select motors

- On the basis of power required
- On the basis of weight limitation
- On the basis of task needed to be performed
- Power=Torque*RPM
- If power is constant- Speed α 1/Torque

Relation between torque and RPM in motors

- Torque is inversely proportional to RPM ,i.e, RPM increases with decrease in torque and vice versa at constant current and voltage
- Torque increases with increase in current
- RPM increases with increase in voltage

Motor Mounts



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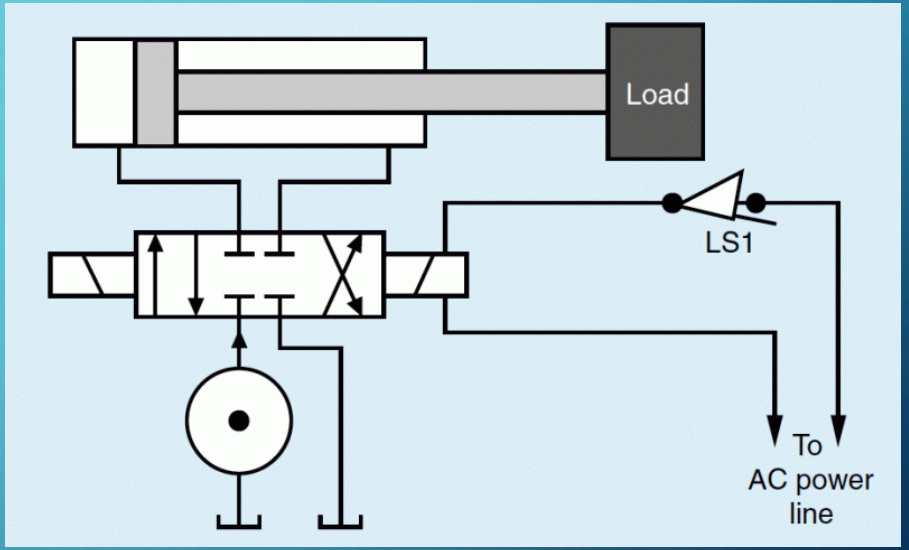
Hydraulic actuators

- Hydraulic actuators employ hydraulic pressure to drive an output member
- Used where very high force is required
- Slow speed



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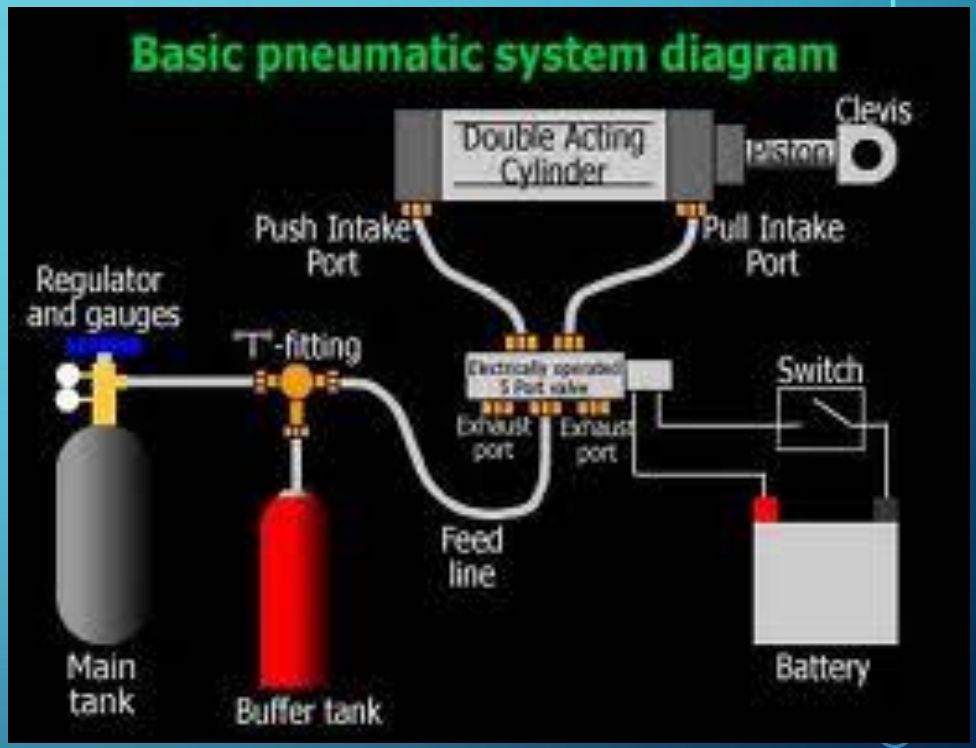
Pneumatic actuator

- Pneumatic actuators employ gas pressure to drive an output member
- Used where very high speed is required
- Generates less force



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Power system

- A robot needs a power source to drive its actuators
- Electric robots use batteries or extension cord
- Hydraulic robots needs pumps to pressurize the hydraulic fluid
- Pneumatic robots need air compressors

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Types of Batteries

The main battery types are: lead-acid (Sealed Lead Acid), nickel-cadmium (NiCd), nickel metal hydride (NiMH), alkaline, and lithium.

1. Sealed Lead Acid:-SLA batteries have lead-based electrodes, and electrolyte composed of sulphuric acid.
2. Nickel-Cadmium:-NiCd batteries use nickel as cathode, and cadmium as anode. They supply high currents without significant voltage drops.
3. Lithium:-Very used in cellular phones, portable computers and several other gadgets, lithium batteries currently are the ones with the highest charge capacity with lowest weight. It suffers risk of explosion if perforated and exposed to oxygen, shorted out, or improperly charged.

Types of Batteries

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Types of Batteries

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Types of Batteries

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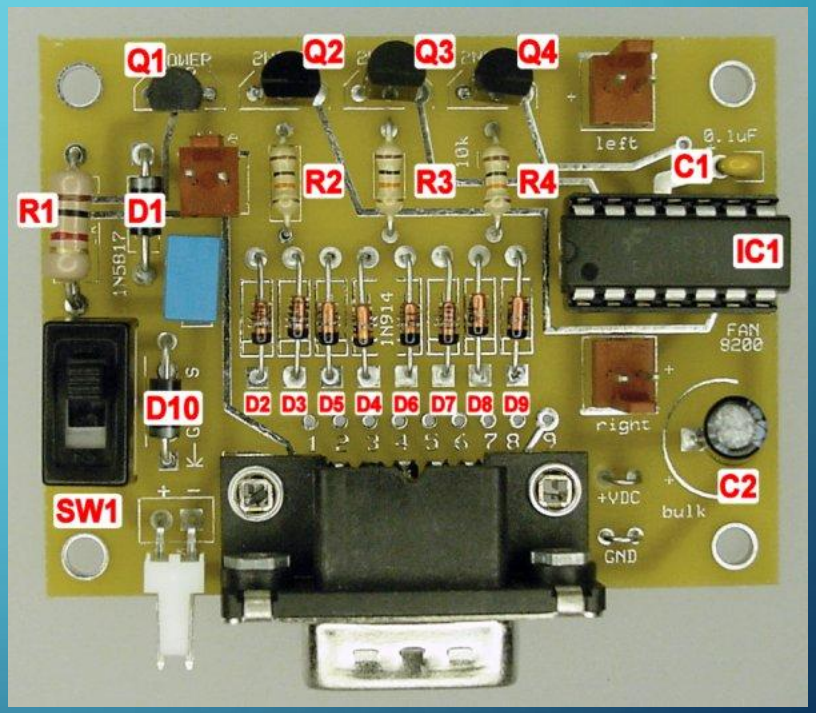
How to select the battery?

- Voltage Rating
- Ampere-Hour Rating-A battery with a capacity of 1 amp-hour should be able to continuously supply a current of 1 amp to a load for exactly 1 hour, or 2 amps for 1/2 hour, or 1/3 amp for 3 hours, etc., before becoming completely discharged.
- Max. Current Rating
- Chargeable-Non Chargeable

Electrical circuit

- The electrical circuit powers the electric motor or valves that controls hydraulic or pneumatic systems



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Different Switches

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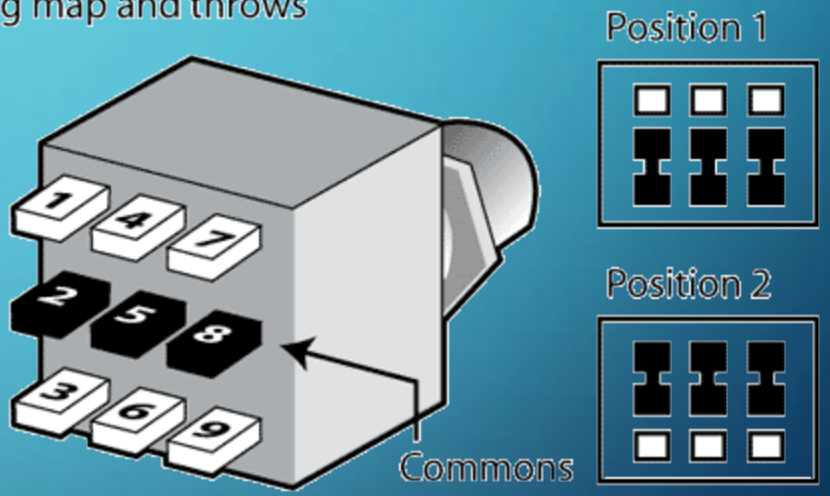
DPDT

TPDT

Diagram 5
Lug map and throws



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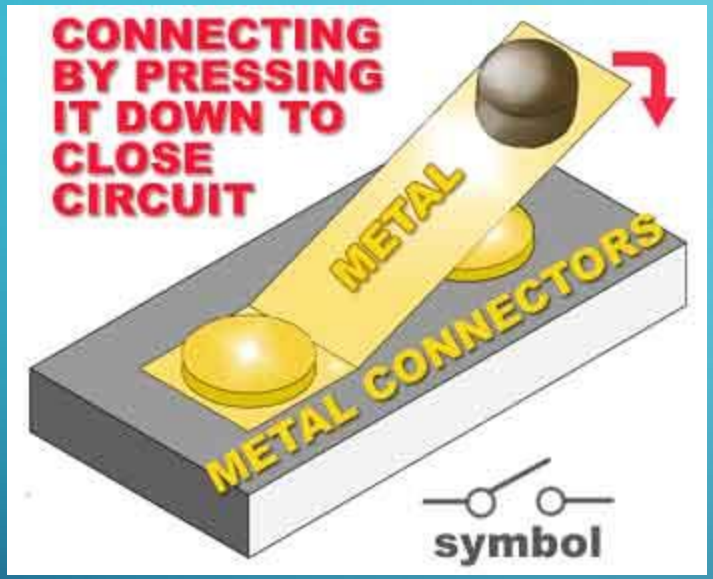
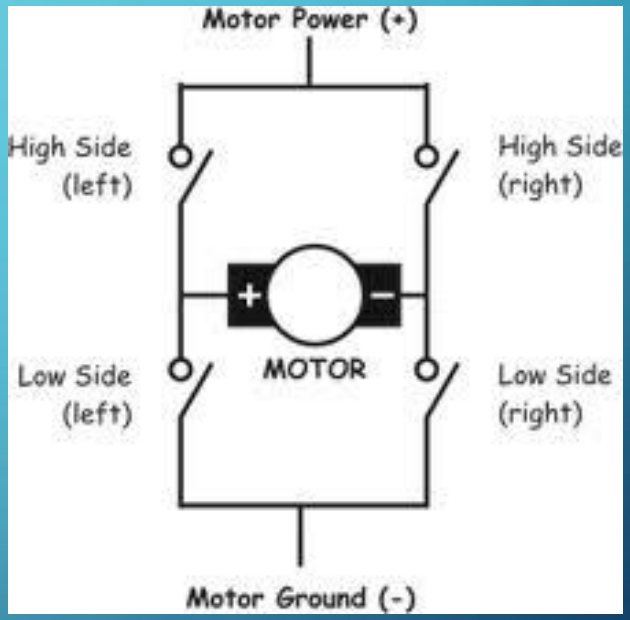
Mechanical Switches



H-Bridge



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Connection of DPDT to make an H-Bridge

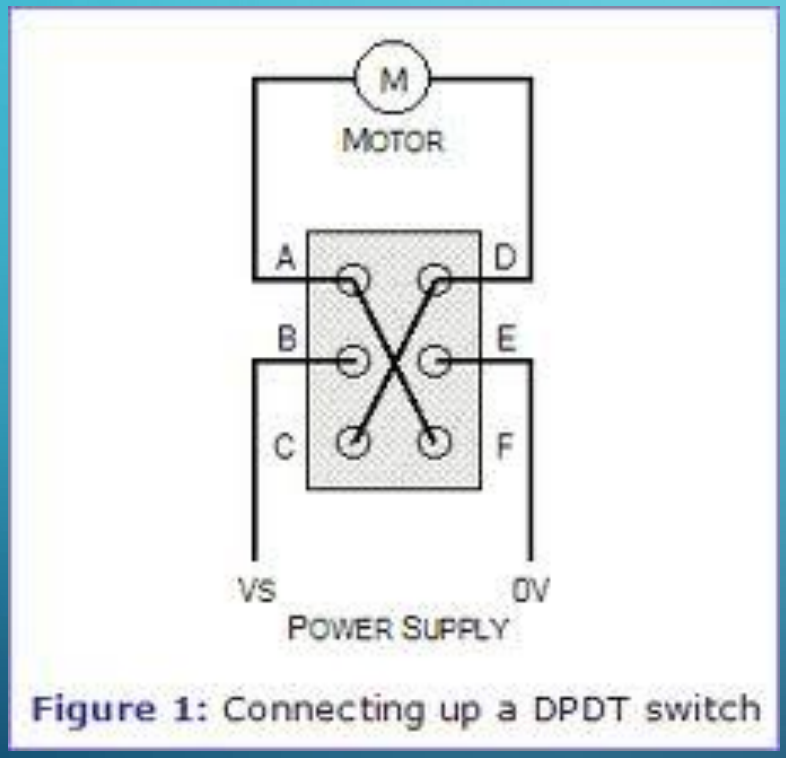
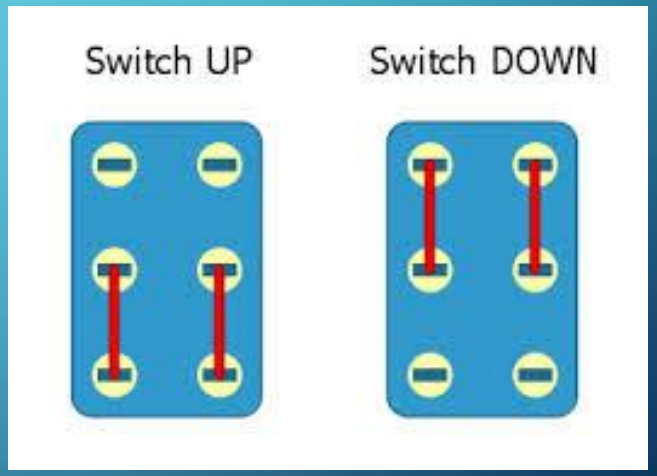


Figure 1: Connecting up a DPDT switch



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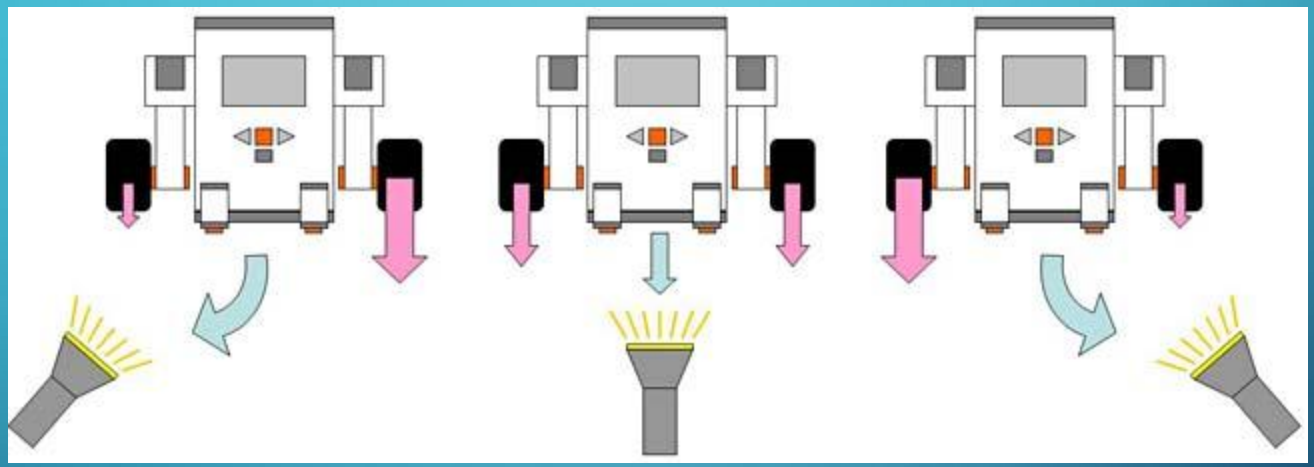
Steering



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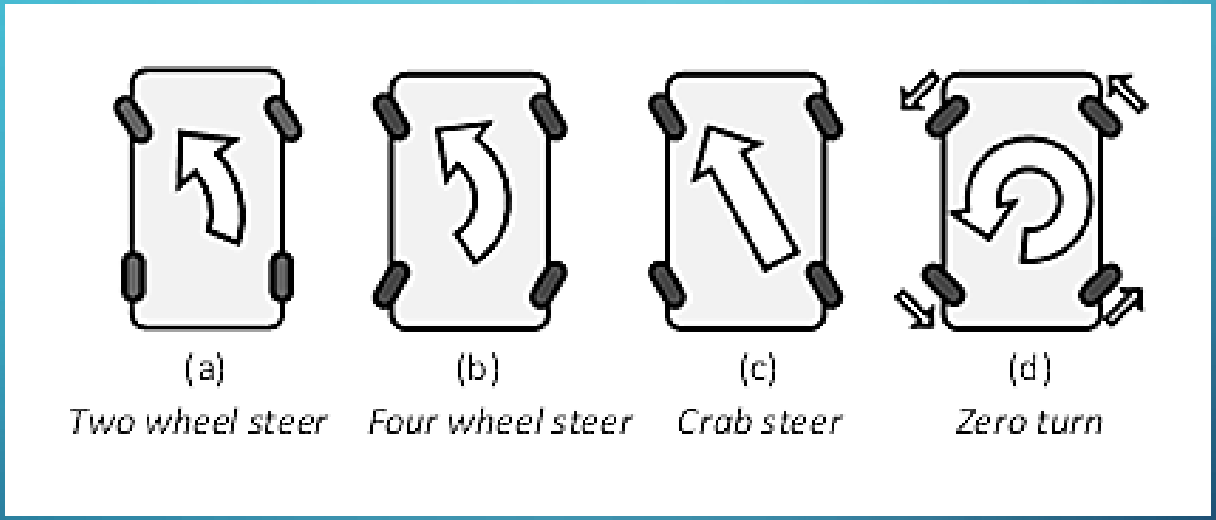
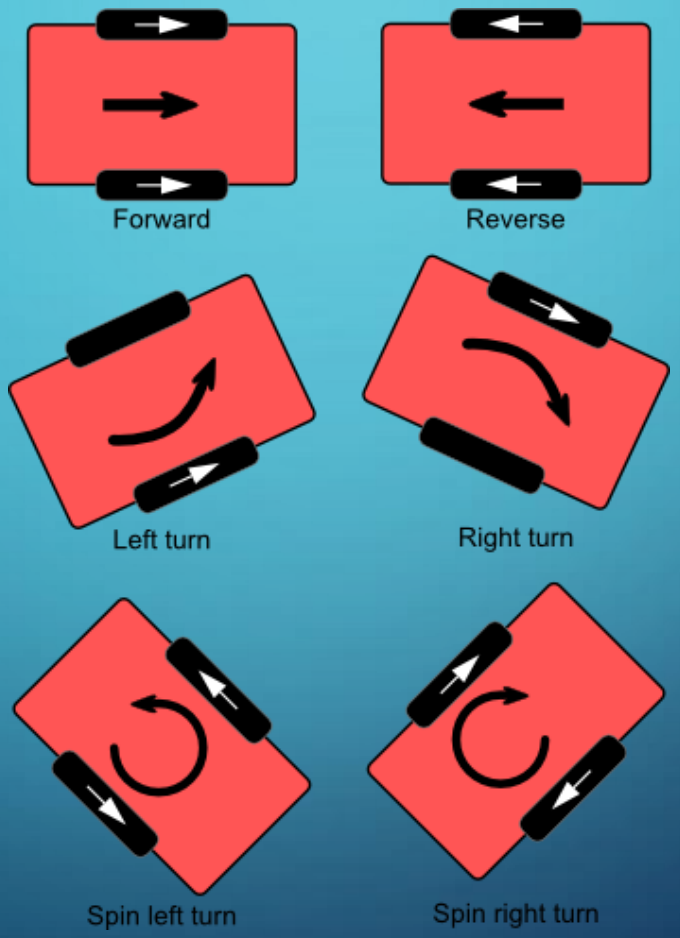
Different Turns



Driving Mechanism



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Applications

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Applications

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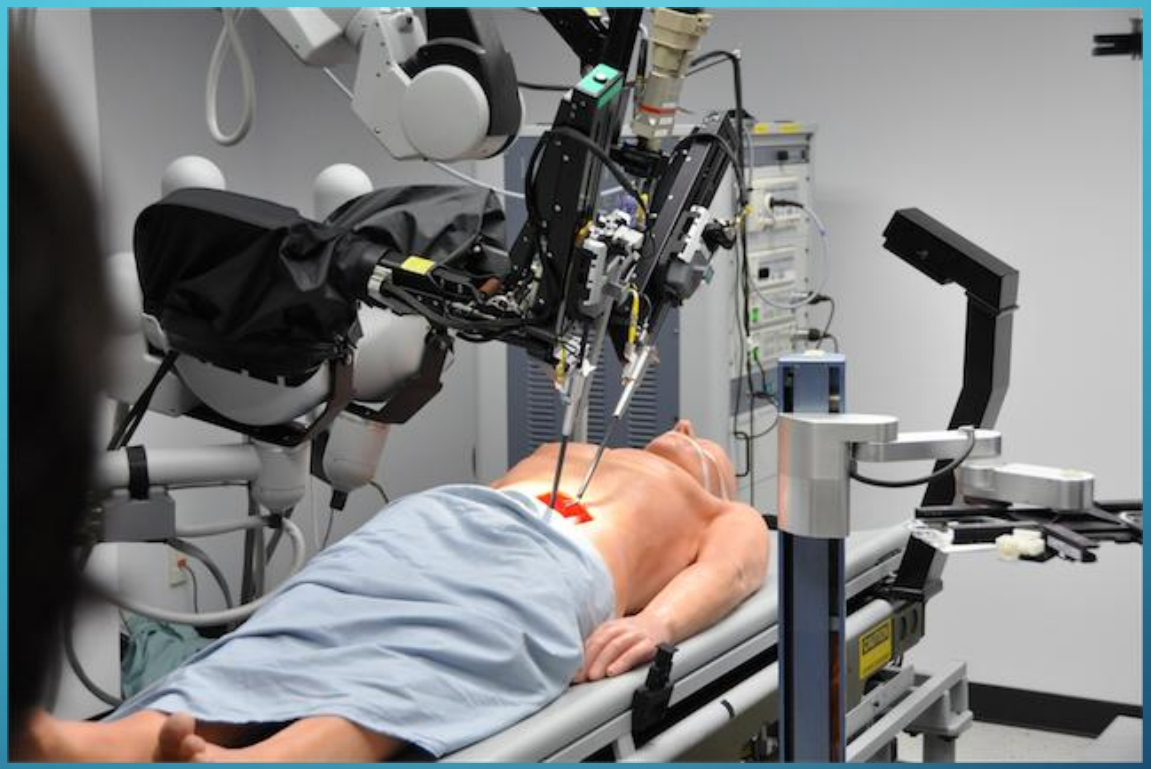

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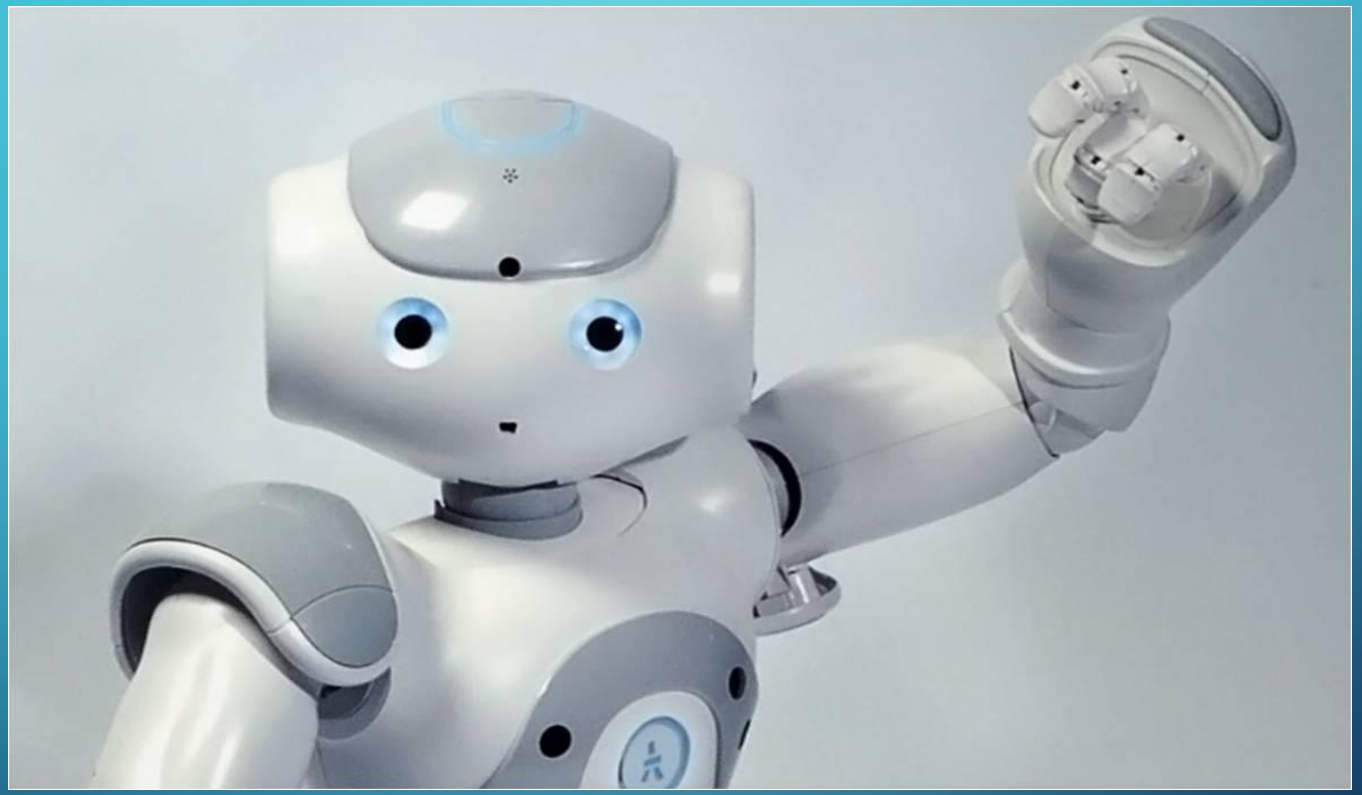
Competitions

- ABU Robocon
- International Aerial Robotics Competition
- National Engineering Robotic Contest
- Robogames
- Indian Robot Olympiad
- Robotryst
- National Robotics Competition
- Techfests-www.knowafest.com

Future in Robotics



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- Humanoids
- Medical
- Robots in space
- Can be used at hazardous places

Mistakes made by us

- Mobility problem
- Wheel alignment
- Backlash in wheels
- Balancing problem
- CG problem
- Rigidity
- Speed variation due to gravity
- No Backup plans
- No extra material

Thank You